

Problems and relevant strategies on natural forest protection in Changbai Mountain forest area

WANG Xian-cheng

Jilin Provincial Academy of Forestry Science, Changchun 130031, Jilin Province, P. R. China

Abstract: Changbai Mountain forest area is not only is a national timber base but also a green ecological defense for Songliao Plain of NE China. The Natural Forest Protection Project of this area has an important bearing on the social and economic sustainable development of Jilin Province or even the whole forest area in NE China. This paper summarized general conditions of natural forest in Changbai Mountain state-owned forest area and put forward six problems need to be urgently solved and five strategic suggestions on natural forest protection and sustainable management.

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General conditions of natural forest in Changbai Mountain forest area

Changbai Mountain forest region, which is always called Changbai immense forest, making up roughly four-fifth of the total forest resources of Jilin, is not only timber productive base of nation, but also a green ecological defense for Songliao Plain of NE China. Improvement of forest ecological environment of Changbai Mountain forest region will be of great importance to sustainable development of NE China's social economy.

The whole Changbai Mountain forest area (126°14' to 131°18' E and 41°22' to 44°22' N) is included in Natural Forest Protection Project (NFPP). It covers a land area of 4.016 million hm^2 , accounting for 21.3% of total land area of Jilin Province. There are 18 state-owned forest industry bureaus, 4 forest management bureaus and one Nature Reserve to be located in this region (Zhang *et al.* 1999).

The topography and geomorphology of Changbai Mountain forest area is composed of low mountains and hills, which inclines from southeast to northwest. Most of the mountains and hills are over an elevation of 800 m. Of them, the Baiyun Peak, which is the highest peak of Changbai Mountain, is 2691 m. The climate of this area is temperate continental monsoon climate. Mean annual temperature is 2 to 6 °C. Frost-free period is 90 to 140 days. Annual precipitation is in range of 600 to 1000 mm. The soils are mainly dark brown forest soil and secondarily brown coniferous forest soil, white paste soil, meadow soil and swamp soil, etc.

The area of natural forests in Changbai Mountain is up to 2.989 million hm^2 , accounting for 91.4% of the forested

lands (Wang 1992). And its stand stock takes up 95.5% of that of the forested lands. The regional forest vegetation is mixed broadleaved and coniferous forest with main characters of *Pinus korensis*, *Picea* spp. and *Abies* spp. The forest vegetation in this area varies with topography and altitude and presents obvious vertical forest distribution zone. Deciduous broadleaved forest is distributed under a elevation of 500 m above sea level, broadleaved and coniferous mixed forest is distributed in low mountains at altitudes of 500-1100 m, mountain coniferous forest is distributed at altitudes of 1100-1800 m, subalpine Ermans birch (*Betula ermanii*) forest is distributed at altitudes of 1800-2100 m, and alpine tundra is at an altitude of above 2100 m.

More than 2000 species of wild animals and plants are distributed in this area and the microorganism resources are also rich (Li 2002). Changbai Mountain forest area is not only an important base for timber and other forest specialties but also a green ecological defense for water resource containing of Songhua River, Yalu River, Tumen River, Suifen River and Dongliao River and for ecological balance preservation of Songliao Plain.

However, in a long history, the timber production and economic benefit were always put in the first place, and less attention was paid on the ecological benefit and protective roles of natural forests in Changbai Mountain.

By comparatively analyzing the exploitation of forest resources and the conditions of forest ecological environment in 1970's to 1990's in Changbai Mountain forest area, the following concerned facts could be found:

Mature and overmature forest decreases greatly and forest ecosystem degenerates seriously.

Because of over-exploitation and over-cutting, the virgin forest resources have been almost exhausted except for that in Changbai Mountain Nature Reserve. The natural mixed broadleaved and coniferous forest in climax community had been replaced by poor middle aged and young

Biography: WANG Xian-cheng(1945-), Senior Researcher, Doctoral Supervisor Jilin Provincial Academy of Forestry Science, Changchun 130031

Email: jllky@public.cc.jl.cn

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stand with much anthropogenic disturbance, due to predatory selective cutting and large scale clear-cutting. The statistic data showed that, from 1975 to 1996, the area of mature and over-mature forest decreased from 1.428 million hm^2 to 0.748 million hm^2 and stand stock decreased from 287 million m^3 to 151 million m^3 , while the area of middle-aged and young stand increased from 0.927 million to 2.338 million hm^2 and their stand stock increased from 67 million to 252 million m^3 . It indicated that most of the virgin forests in climax state had degenerated to natural secondary forest by human disturbance. To 2000, It was reported that the stable overmature forest in state-owned forest area of Jilin Province was 112.5 thousand hm^2 , which only account for 3.67% of that of forested land.

Forest bio-diversity was reduced and rare tree species are on verge of extinction

Over-exploitation of forest resource resulted in many species and genetic material of rare tree species and economic plants to be lost. Data of forest inventory showed that, from 1986 to 1996, the area and stock of natural *Pinus koraiensis* forest in Changbai Mountain reduced from 129 thousand hm^2 to 18 thousand hm^2 and from 27.3635 million hm^2 to 4.322 million hm^2 respectively, that means only 11.8% of the area and 16 % of the stock were left. The area of *Pinus koraiensis* forest only takes up 0.3% of that of natural forests. Besides, the area and stock of *Picea-Abies* forest decreased by 39.9% and 43.0% respectively and the area and stock of *Fraxinus mandshurica* and *Juglans Mandshurica* decreased by 76.7% and 76.5% respectively. Also, some of other rare species such as *Taxus cuspidata* Sieb. Et Zucc have been hardly to be seen.

The forest landscape tends to be fragmentation.

Just after establishment of new China (1949), the landscape ecological background of Changbai Mountain forest area was virgin forest with less human disturbance. Up to 1986, the area of mature and overmature forest was decreased by 70.9%, and to 1996, the forest landscape had a qualitative change that 85.1% of virgin forest were replaced by severely damaged over-cutting forest, natural secondary forest and plantations (Bai 2000). Intensive over-cutting, deforesting for farmland and denudation resulted in a serious damage of the virgin forests and forest landscape was broken into fragments, particularly around the location sites of the forestry bureaus and forest farms.

The stability of forest ecosystem was reduced.

The statistic data showed that the artificial forests were increased from 45 000 hm^2 in 1963 to 4 310 000 hm^2 in 1996 in Changbai Mountain state-owned forest area and more than 70% of the plantations were pure plantations dominated by larch species. Those artificial forests are easily infected or damaged by forest disease, insect pest and mice. In addition, the forest ecosystem lost its inherent ecological balance and the stable forest community

changed to unstable one, due to the fact that the virgin forests had been replaced by over-cut forest and secondary forest and that large area of broadleaved and coniferous mixed forests had disappeared. As a result, the stability of the forest ecosystem was unavoidably decreased.

The ecological economic function of the forest decreased.

The large-area harvesting of virgin forests in Changbai Mountain had damaged the function of forest for protection of water source and soil and water conservation. In recent fifty years, the forest coverage along Hailan River basin in Yanbian Autonomous Prefecture, Jilin Province, was reduced from 80% to 45.4% (Sheng 2001). The runoff volumes of rivers dropped 70% on average and average annual soil erosion of cultivated land on slopes was 1.5 mm in depth (Zhu 2002). Since 1986, there have been five great flood disasters happened in Changbai Mountain area. Of them, the rarely great flood disaster in 1995 caused direct economic loss of 28.3 billion. Besides, in recent ten years, drought in the spring and summer has been aggravated frequently. Besides the general circulation, we cannot say that it has nothing to do with disappearance of large area of virgin forest and decreasing of ecological economic function of the forest in Changbai Mountain.

The facts above reveal that the foresters are facing a extremely difficult task for natural forest protection in Changbai Mountain forest area. If these problems are not to be solved, the severer consequence will be brought about to regional social economics of Jilin Province or even Northeast China.

The important problems demanding prompt solution for NFPP of Changbai Mountain forest area

The implementation of NFPP marked that the forestry construction in state-owned forest area has entered into a new historical developing stage. In this historical stage, in the focal point of work in state-owned forest area must be shifted from timber production of traditional planned economy to forest resource protection, silviculture and comprehensive development of forest resource. Thus, according to the practical situation of NFPP in Changbai Mountain forest area, we must conscientiously deal with the following facts.

Indicator system for NFPP

An operational indicator system for NFPP must be established for a standardized NFPP. A series of detail definitions should be given out in the indicator system, including the ratio of public benefit forest and commercial forest, ratio of important public benefit forest and common public benefit forest, quantitative indices about management measures, management intensity, species composition and age structure of all the forest types for common public benefit forest as well as the quantitative measures and objectives of management for all types of commercial forests. All

these aspects should be standardized and relevant criteria should be established on basis of survey and study, so that an indicator system should be formed to guide the practice of NFPP.

There is no ready-made indicator system for NPFF which we can copy. It must be innovated unceasingly from the realities. The establishment of the indicator system should benefit to the restoration of natural forest resources, conservation of the rare wildlife species, increase of bio-diversity, and to the stability and function strengthening of the forest ecosystem. Basically, it should benefit to protection of natural forest and sustainable development of state-owned forest area.

Classified management

A key point for NFPP implementation is to carry out the classified management. The present classified management of "two classifications and three divisions" is much influenced by decrease in timber output (Wang 2000) and it is difficult to make scientific management and treatment in accordance with local conditions

The starting point for classified management of "two classifications and three divisions" should stress on the natural conditions, ecological economic function and management direction of the natural forest blocks. In fact, even in the same compartment the site condition, forest type, species composition, forest type attribute, age condition, management direction and ecological economic function of different sub-compartments are not the same. Thus, in common situation, the compartment should not be as the unit of division. Classified management doesn't equal to zoning management. To implement sustainable management of natural forest, sub-compartment must be taken as the management unit. Only implementing the classified management to the sub-compartments, could intensive farming and scientific management be realized. Otherwise, it is difficult to realize the planned aims of NFPP.

Technical regulations for NFPP

NFPP is a system engineering of forest restoration, which will benefit either the present or the future generations. Its implementation must rely on advance of science and technology. Although the central and local governments had made some technical regulations of NFPP, these regulations are not very scientific or operational for guiding NFPP. Therefore, by learning the advanced achievements from domestic and foreign countries, we should lay down suitable technical regulations that tally with the actual situation of local areas for NFPP. Enacting technical regulations should be based on raising scientific and technical content of NFPP. The detail operational rules for some technical points such as significance, purpose, principle and content of NFPP should be given, and specific request should be put forward on tree improvement, selection of tree species, site selection, selection of forest type and instruction of tree species instruction. Natural and eco-

nomics laws of NFPP should be followed. The regulations should be scientific, advanced, practicable and operational and embody the character of local NFPP fully.

Implementation of plan and quality management

To carry out NFPP well, we should pay close attention to working out the plan, implementation of the plan as well as management of the project quality. At present, NFPP is starting quickly, but there exist some weak points in check and guide of implementation of plan and management of program quality. To realize the objective of sustainable management of NFPP, we must lay down scientific, practicable and operational plan tallying with local situation and carry out it well. It is necessary to organize a technical group to ensure the smooth implementation of all the links of NFPP and to guarantee the quality of all the engineering to meet the national demand.

Demonstration projects of NFPP

The model projects of NFPP should include: the models of important public benefit forest such as water resource-containing forest, soil and water conservation forest, bank and dam-protection forest, and other shelterbelt and special-use forest; the models of common ecological public benefit forest such as nurse-crop, alternative cutting nursery forest, low quality improvement forest, artificially promoting regeneration forest, closed forest and management of ecological economic valley; the models of commercial forest such as regeneration cutting forest, intensive farming forest, short rotation industry forest and the other commercial forest. Besides, model forests for improved varieties, optimized tree species, mixed broadleaved and coniferous forest as well as for technological measures should be also considered. All kinds of model projects should have a relatively broad scale and should have a combined purpose on demonstration and testing. The experience learned from the realities will promote the NFPP to a scientific, standardized and intensive direction of sustainable management.

Information system of NFPP

Global Positioning System (GPS), Remote Sensing (RS) and Geographic Information System (GIS) and other hi-techs could be adopted in the management and monitoring of resource information, thus providing a good insurance for scientific management and intensive farming of NFPP.

To establish a NFPP management system is inevitable. The current measures for management and monitoring of forest resource information in Jilin are still backward, which cannot meet the need of digital forestry. Firstly, by adopting the high and new technology such as RS, we should conduct an inventory of forest resources in NFPP area of Changbai Mountain; Secondly, we should pay close attention to personnel training, purchase necessary equipment, and establish a GIS network for natural forest resource in

Changbai Mountain forest area; Thirdly, we should set up a dynamic monitoring system of NFPP in Changbai Mountain with 3S technology.

Suggestions

Clarify the policies and developing direction for construction of state-owned forest area

With the guide of ecological economic theories, the management and operating system fitting to socialism market economy should be established. With centering on natural forest protection and forest resources silviculture, we should develop the silviculture industry, forest products processing industry and tertiary industry and promote comprehensive development of forest resources. In this way the realization of crossover sustainable development of Changbai Mountain state-owned forest area could be promoted according to modern models of ecological forestry.

Establish incentive system and bring the initiative of mass foresters into play for caring the natural forest and taking part in NFPP

Close attention should be paid to the industrialized silviculture and operating system that fits to socialism market economy should be established for natural forest protection and forest resources silviculture. The incentive action of economic lever should be played fully.

The system for contracted management responsibility of natural forest in state-owned forest area should be worked out and implemented. So the initiative for nursing the forest and developing local forestry economy of mass foresters and community residents could be brought out.

Relieve the social loads of industry business of state-owned forest area by developing types of forest regional economy

Firstly, support development of non-state-owned forestry. With the precondition that ensure the national estate not to be lost and benefit to construction of state-owned forest area and natural forest protection, forestry industry of individual proprietorship or shares should be encouraged.

Secondly, service industries should be separated from the state-owned series and carry out transferring the right, renting or contracted management.

Thirdly, the public benefit undertakings that should not be undertaken by forestry enterprises are transferred to local government or other departments concerned. In this way, the load of the forestry industry business could be relieved.

Amend regulations for forest resources cutting to establish regulations fitting market economy.

Regulations of norm cutting for common public-benefit-forest and commercial timber forest should be made out. Standardized management should be laid down for main cutting of mature and over-mature natural forest,

tending cutting of middle-aged forest and management cutting of plantations. A flexible annual target on intermediate cutting of middle and small-diameter trees should be appraised and decided according to the local conditions, with a precondition that stand stock, forest stand quality, forest coverage and natural forest restoration are not influenced. With the limit total target, according to the demand on timber market, the units of forest cutting should be allowed to adjust the annual norm.

Regulate the economic policies for state-owned forest area and make an atmosphere benefit to NFPP

A developing fund for public-benefit undertakings of forestry can be raised, so as to accumulate fund for natural forest protection and giving full play of ecological function of public-benefit forest in state-owned forest area. This fund should not be afforded by forestry business but by nation or benefit-receiver. For smoothly implementing NFPP in state-owned forest area, necessary fund must be provided for local government or the concerned departments to undertake the public-benefit undertakings that were formerly undertaken by state-owned forest industry business.

During the adjusting period of industrial structure in the state-owned forest area, some favorable policies should be given to forest industry business for switching over production and initiating industry benefit to natural forest protection.

For the state-owned forest area undertaking great ecological responsibility, the tax categories and tax rate of forest industry business should be decreased. And the tax income should be spent on natural forest protection and forest resource silviculture only.

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